

WHAT IS CLAIMED IS:

1. An electronic circuit unit having a circulator, comprising:

a circuit board which is obtained by laminating a plurality of dielectric substrates and in which an electric component is provided to form a desired electronic circuit;

first, second, and third central conductors provided for the circuit board and partially intersecting with each other in the upper and lower directions;

a magnet and a ferrite member disposed above and below the intersection of the central conductors;

a first yoke for covering the outside of the magnet; and

a second yoke for covering the outside of the ferrite member,

wherein the first, second, and third central conductors are provided on the plurality of dielectric substrates and are formed by laminating the plurality of dielectric substrates;

a cavity for accommodating the ferrite member is provided at a lower section of the circuit board in which the central conductors are disposed;

a plurality of through holes vertically passing through the circuit board are filled with a magnetic material; and

a magnetic path is formed by the magnetic material between the first and second yokes disposed above and below

the circuit board so as to cover the magnet and the ferrite member, to make a closed magnetic circuit.

2. An electronic circuit unit having a circulator according to Claim 1, wherein the magnetic material is formed by filling the through holes with a paste including a magnetic powder.

3. An electronic circuit unit having a circulator according to Claim 1,

wherein at least one of the first and second yokes has a cylindrical side wall, and

the dielectric substrate is provided with a ring-shaped magnetic pattern which opposes the end section of the side wall and which is connected to the magnetic material.

4. An electronic circuit unit having a circulator according to Claim 3, wherein the magnetic pattern is provided for each of the dielectric substrates positioned between the first and second yokes.

5. An electronic circuit unit having a circulator according to Claim 3,

wherein the ferrite member is disposed in the cavity; the magnet is disposed on the upper surface of the circuit board;

the first yoke having the cylindrical side wall is

disposed so as to cover the outside of the magnet; and

the second yoke having a plane shape is disposed so as to cover the outside of the ferrite member and to block the cavity.

6. An electronic circuit unit having a circulator according to Claim 1,

wherein an electrically conductive pattern is provided on the front surface of a first-layer dielectric substrate disposed at the top of the circuit board;

the first, second, and third central conductors are provided on dielectric substrates disposed below the first-layer dielectric substrate; and

one end of each of the first, second, and third central conductors is connected to the electrically conductive pattern by a through-hole conductor filled in a hole provided in the circuit board.

7. An electronic circuit unit having a circulator according to Claim 6, wherein the other end of each of the first, second, and third central conductors is grounded through a through-hole conductor filled in a hole provided in the circuit board at a position closer to the center than the ring-shaped magnetic pattern.

8. An electronic circuit unit having a circulator according to Claim 7, wherein the through-hole conductor

connected to the other end of each of the first, second, and third central conductors is connected to one highly electrically conductive member.

9. An electronic circuit unit having a circulator according to Claim 5,

wherein a capacitor for the circulator is provided on the upper surface of the circuit board by printing at a position outside the first yoke, and

the capacitor can be trimmed after the first yoke has been mounted.

10. An electronic circuit unit having a circulator, comprising:

a circuit board obtained by laminating a plurality of dielectric substrates;

first, second, and third central conductors provided for the plurality of dielectric substrates at intervals of 120 degrees and partially intersecting with each other in the upper and lower directions;

a magnet and a ferrite member disposed above and below the intersection of the central conductors;

a first yoke for covering the outside of the magnet; and

a second yoke for covering the outside of the ferrite member,

wherein one end of each of the first, second, and third

central conductors serves as an input and output terminal, the ends being disposed at intervals of 120 degrees; and adjacent input and output terminals are connected by inductive elements.

11. An electronic circuit unit having a circulator according to Claim 10,

wherein electrically conductive patterns are connected to the input and output terminals, and microstriplines for connecting the electrically conductive patterns are provided on the circuit board; and

the microstriplines are formed of the inductive elements.

12. An electronic circuit unit having a circulator according to Claim 10, wherein the resonant frequency of a parallel resonant circuit formed of the inductive elements and capacitive components generated between the central conductors by the intersections of the central conductors is made equal to the frequency of a signal input to an input and output terminal.

13. An electronic circuit unit having a circulator according to Claim 11, wherein the resonant frequency of a parallel resonant circuit formed of the inductive elements and capacitive components generated between the central conductors by the intersections of the central conductors is

made equal to the frequency of a signal input to an input
and output terminal.

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